



United States Department of Agriculture
Research, Education, and Economics

Agricultural Research Service



The Long-Term Agro-Ecosystem Research (LTAR) Network

*Federation of Earth Science Information Partners
Summer Conference
Friday Center
University of North Carolina
Chapel Hill, NC
July 11, 2013*

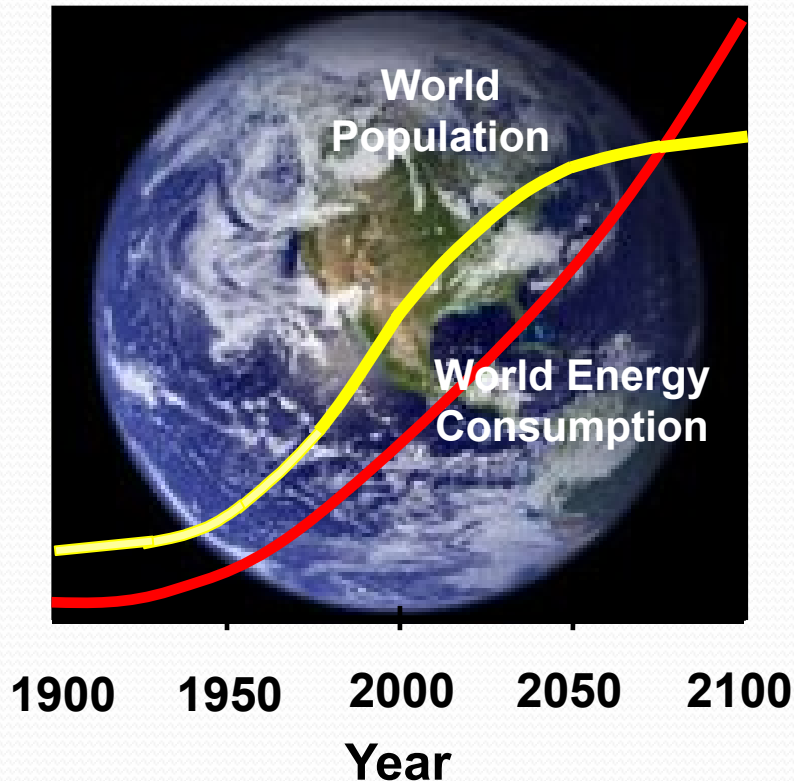
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Challenges Facing Agriculture in the 21st Century



By 2050, agriculture will need to:

- Supply enough food, feed, fiber, & fuel to support a global population of 9 billion people;
- Without depleting our natural resources or degrading our environment;
- Against a background of changes in climate that are expected to alter patterns of temperature and precipitation on which the world's food production systems depend.

These challenges threaten our food security & the availability of fresh water for a variety of needs.

The cover of the report features a dark blue background with a world map. The map is composed of various agricultural scenes: a tractor in North America, a woman in a yellow dress pouring water from a large pot in South America, a person in a hat working in a field in Africa, and a person in a blue shirt working in a field in Asia. The text 'SUMMARY REPORT' is in an orange box at the top right. The title 'THE STATE OF THE WORLD'S LAND AND WATER RESOURCES FOR FOOD AND AGRICULTURE' is in large orange letters, and 'Managing systems at risk' is in white. The FAO logo is at the bottom right.

SUMMARY REPORT

THE STATE OF THE WORLD'S LAND AND WATER RESOURCES FOR FOOD AND AGRICULTURE

Managing systems at risk



- 25% of Earth's lands are already degraded.
- More than $\frac{3}{4}$ of the 70% increase in global food production needed by 2050 will have to come from the 'sustainable intensification' of existing agricultural lands (FAO 2011).

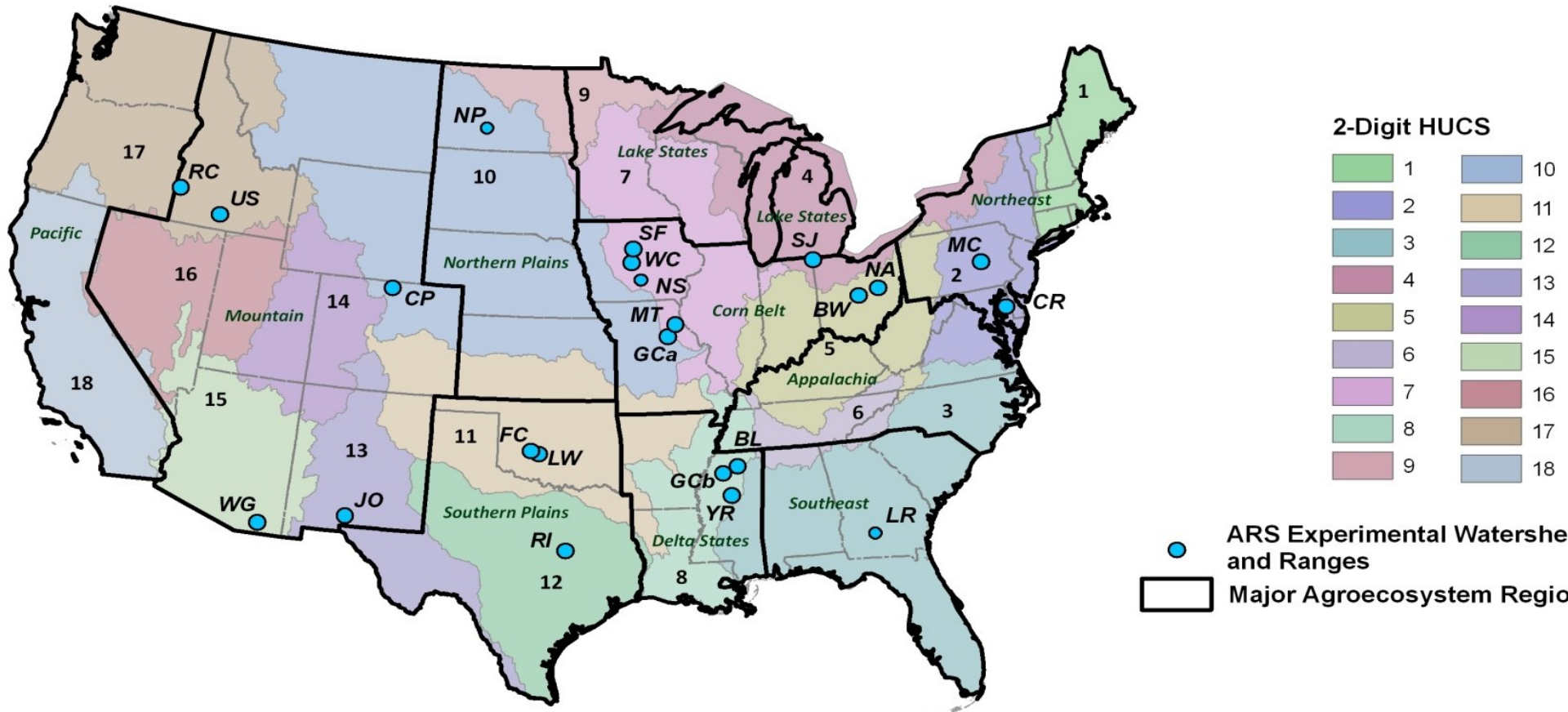
Recent Calls for the Creation of Such a Network for Agro-ecosystems (Walbridge & Shafer 2011) (Similar to NSF's LTER network for Non-Managed Ecosystems)

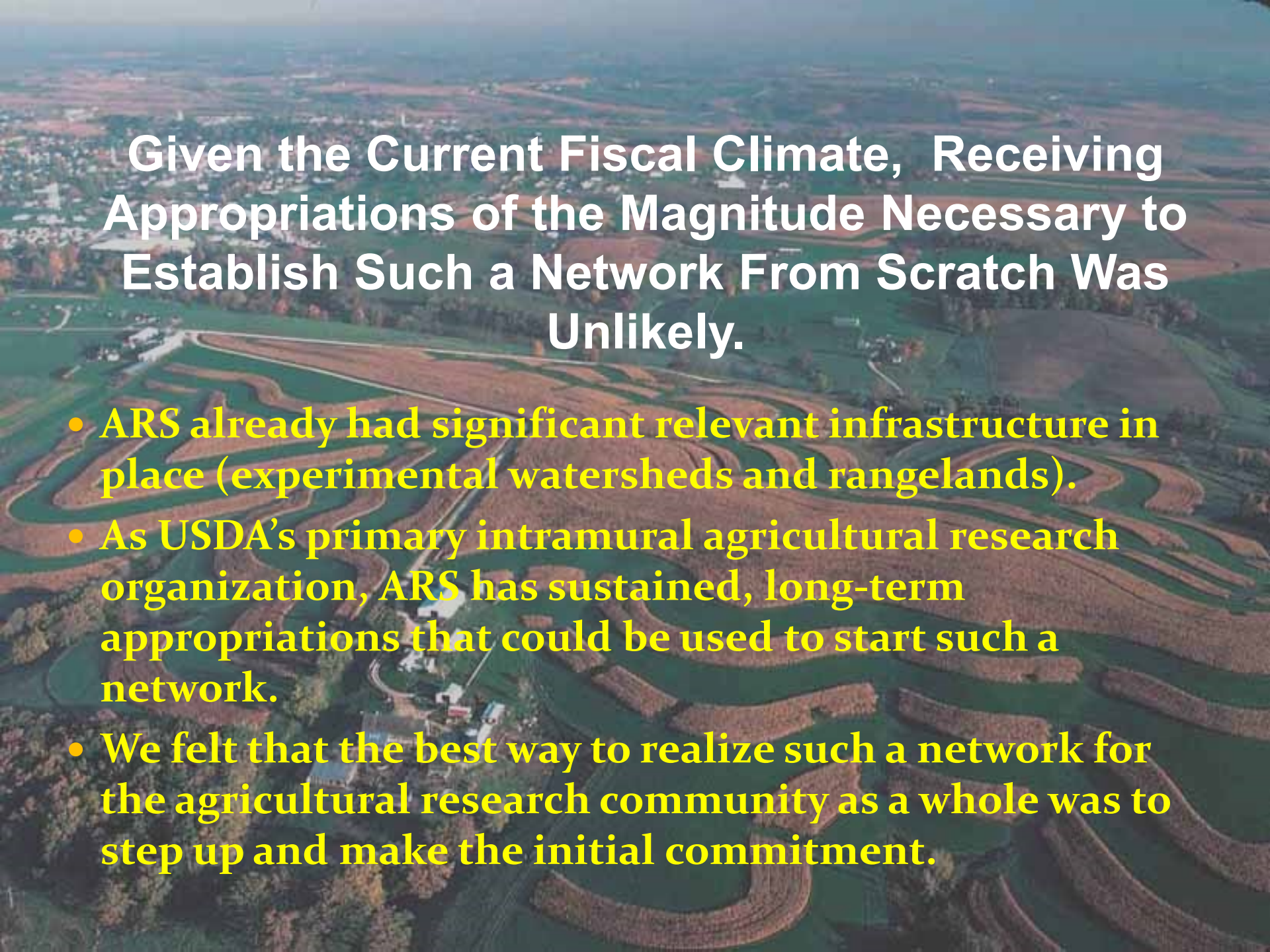
- *Infrastructure to enable research on agricultural processes from field to landscape scales;*
- *To support long-term investigations into key components of the sustainable intensification of agricultural production;*
- *Historical data records would provide a baseline against which to evaluate future changes;*
- *Collect common datasets using shared research protocols over the next 30-50 years—likely representing the most important datasets collected by such a network.*

ARS Benchmark Experimental Watershed and Range Research Sites

Code		Code	
BL	Beasley Lake Watershed	NA	North Appalachian Experimental Watershed
BW	Upper Big Walnut Creek Watershed	NP	Northern Great Plains Research Laboratory
CP	Central Plains Experimental Range	NS	Neil Smith National Wildlife Refuge/Walnut Creek South Watershed
CR	Choptank River Watershed	RC	Reynolds Creek Experimental Watershed
FC	Fort Cobb Reservoir Experimental Watershed	RI	Riesel Experimental Watershed
GCa	Goodwater Creek Experimental Watershed	SF	South Fork of the Iowa River Watershed
GCb	Goodwin Creek Experimental Watershed	SJ	St. Joseph River Watershed
JO	Jornada Experimental Range	US	Upper Snake River/Rock Creek Watershed
LR	Little River Experimental Watershed	WC	Walnut Creek Watershed
LW	Little Washita Experimental Watershed	WG	Walnut Gulch Experimental Watershed
MC	Mahantango Creek Experimental Watershed	YR	Yalobusha River/Topashaw Canal Watershed
MT	Mark Twain Lake Watershed		

Existing ARS Infrastructure That Could Be Used To Start Such a Network.



An aerial photograph of a rural landscape featuring terraced agricultural fields. The fields are arranged in a series of concentric, curved terraces, some of which are planted with crops like corn. In the background, a small town or village is visible, surrounded by more fields and some buildings. The overall scene is a mix of green and brown, suggesting a mix of vegetation and bare soil.

Given the Current Fiscal Climate, Receiving Appropriations of the Magnitude Necessary to Establish Such a Network From Scratch Was Unlikely.

- **ARS already had significant relevant infrastructure in place (experimental watersheds and rangelands).**
- **As USDA's primary intramural agricultural research organization, ARS has sustained, long-term appropriations that could be used to start such a network.**
- **We felt that the best way to realize such a network for the agricultural research community as a whole was to step up and make the initial commitment.**

In Feb. 2012, ARS Announced the Organization of 10 Existing Experimental Watersheds, Ranges, & Research Farms Into an LTAR Network

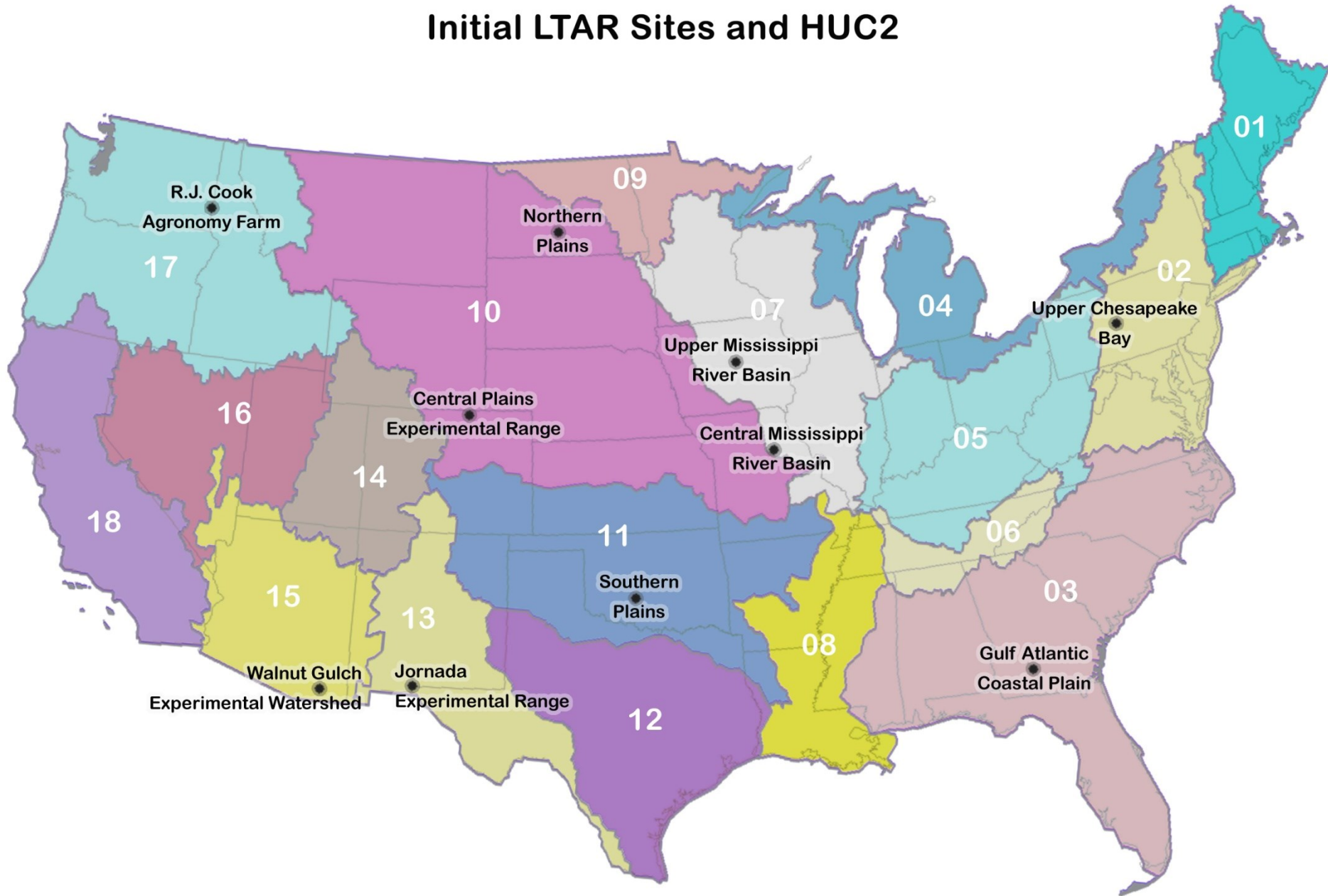
Based on 7 Criteria:

1. **Productivity** – the team's research track record;
2. **Infrastructure Capacity** – presence of an instrumented watershed or other long-term research facility large enough to capture landscape-scale processes;
3. **Data Richness** – the length, breadth, depth, and quality of the existing data record;
4. **Data Availability/Accessibility** -- organization and accessibility of existing data sets;
5. **Geographic Coverage** – how potential sites were distributed in terms of major agricultural production regions, watershed basins, and eco-climatic zones;
6. **Existing Partnerships** – with producers, other stakeholders, universities, etc.;
7. **Institutional Commitment** – to support continued site operation for the next 30-50 years.

THE PROCESS

- 21 ARS locations voluntarily submitted information to address these 7 criteria.
- The 21 applications were evaluated by an ad-hoc panel of experts, as guided by these criteria.
- The 10 sites chosen as the initial LTAR network were those recommended by this ad hoc panel of experts.
- The organization of the LTAR network was formally announced via a USDA press release in September 2012.

Initial LTAR Sites and HUC2



LTAR Network Overview



- 10 sites
- Data Records: 12 (Pullman, WA) to 100 years (Las Cruces, NM and Mandan, ND)
- Area Covered (km²): 0.57 (Pullman, WA) to 6,200 (Ames, IA)
- NEON Domains: 8 out of 17 (in lower 48 states)
- Major Drainage Basins: 8 out of 18 (in lower 48 states)
- Farm Resource Regions: 7 out of 9 (in lower 48 states)

An aerial photograph of a rural landscape. In the foreground, there is a large, flat, golden-brown field. In the middle ground, there are several farm buildings, including a large white barn with a blue roof, a smaller white barn, and a white house. There are also some trees and a small pond. In the background, there are more fields and some distant buildings under a clear blue sky.

Upper Mississippi River Basin LTAR

USDA-ARS, at Ames IA; St Paul MN,
Morris MN, and Marshfield WI, and
Pioneer Farm at the
University of Wisconsin Platteville

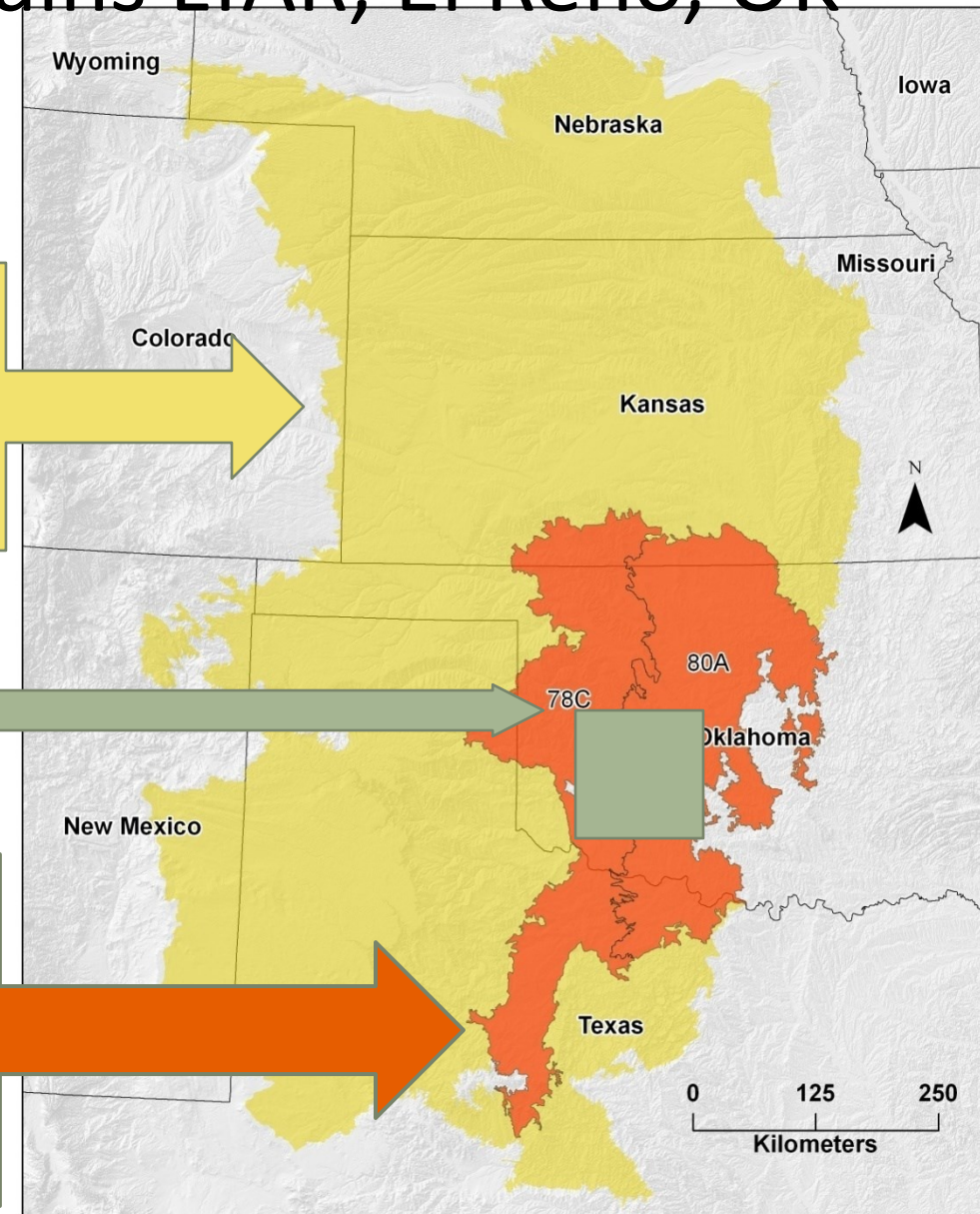
Southern Plains LTAR, El Reno, OK

Central Great Plains
(Rolling Wheat and Range)
Land Resource Area

GRL, El Reno & Langston
Research Watersheds

MLRA 78C Central Rolling Red
Plains

MLRA 80A Central Rolling Red
Prairies of central Oklahoma



Vision and Goal for an LTAR Network

• Vision

- *A sophisticated platform for trans-disciplinary research, conducted over decades on the land in different regions of the country;*
- *Data collected would be geographically scalable;*
- *Research would support the sustainable intensification of the production of agro-ecosystems goods and services.*

• Goal

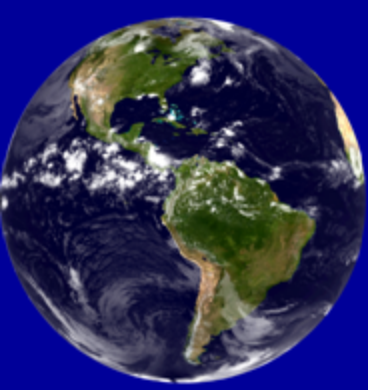
To sustain a land-based infrastructure for research, testing of management options & alternatives, and education, that enables understanding and forecasting of the Nation's capacity to provide agricultural commodities and other ecosystem goods and services under changing environmental and resource-use conditions.



LTAR Network Operating Principles



- Develop research questions that are shared and coordinated across sites.
- Provide the capacity to address large-scale questions across sites through shared research protocols.
- Collect compatible datasets across sites, and provide the capacity and infrastructure for cross-site data analysis.
- Facilitate and foster shared engagement in thinking and acting like a network.



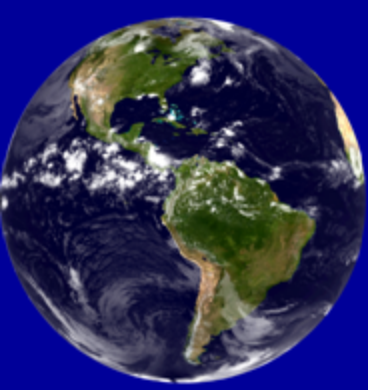
Long Term Agro-Ecosystem Research Network

Shared Research Strategy

SRS Writing Team: Ray Bryant, Kris Havstad, Phil Heilman, Peter Kleinman, Thomas B. Moorman, M. Susan Moran, Jean L. Steiner, and Timothy Strickland

Network Goals

- Ensure sustained crop and livestock production and ecosystem services from agro-ecosystems;
- Forecast and verify the effects of environmental trends, public policies, and emerging technologies.



Long Term Agro-Ecosystem Research Network

Shared Research Strategy

Four Priority Areas of Concern

- 1) Agro-ecosystem Productivity;
- 2) Climate Variability and Change;
- 3) Conservation and Environmental Quality;
- 4) Socio-economic Viability and Opportunities.

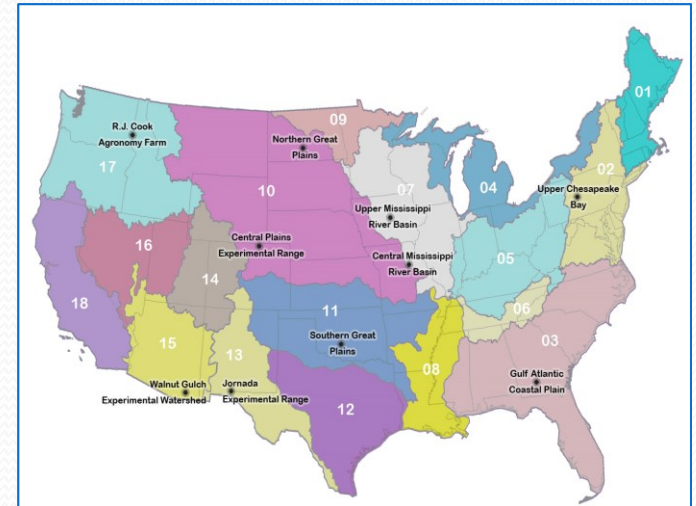
Four Key Products

- 1) New knowledge of processes & systems;
- 2) New technologies & management practices;
- 3) Improved agro-ecological models;
- 4) Comprehensive, accessible data.

Current Partners in the LTAR Network

(<http://www.ars.usda.gov/ltar>)

- 60 colleges and universities
- 15 U.S. Government agencies
- 12 state government agencies
- 11 established research networks
- 25 non-governmental organizations
- 19 private industries or associated organizations
- 29 international collaborations

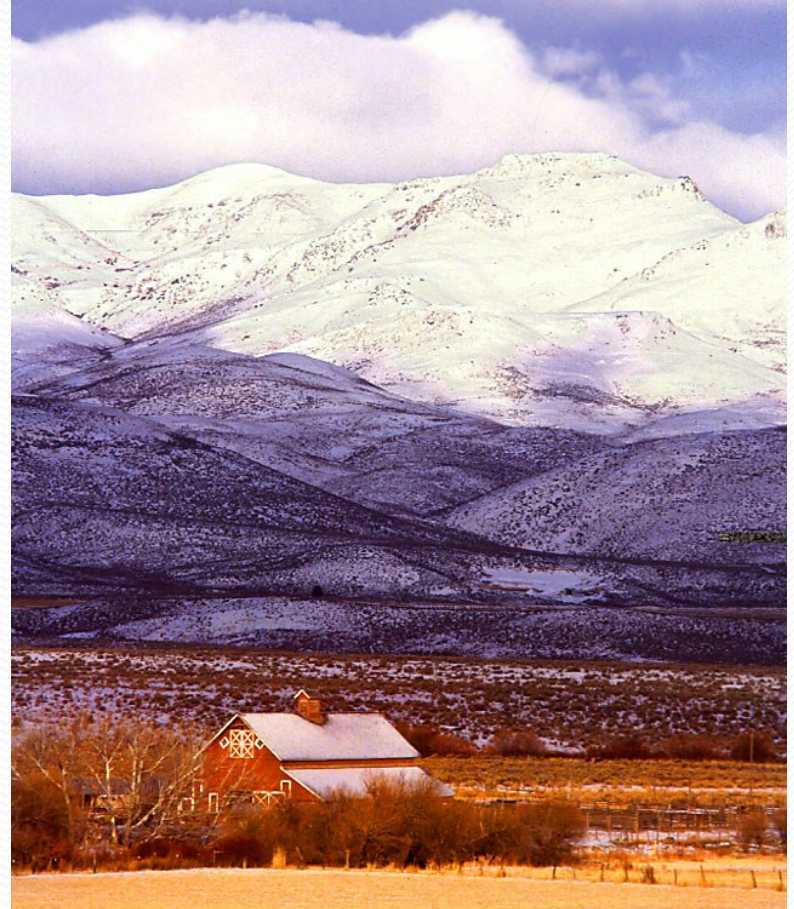


The Future

- **The LTAR Network is ARS' Research Platform to Support Its Future Conservation Research**
- **Enhance Linkages With CZO, LTER, NEON, and Other Networks**
- **Address Key Gaps by Adding:**
 - Additional ARS sites that can increase capacity to meet criteria;
 - Sites operated by other Federal agencies, colleges & universities, or other organizations that meet criteria:
 - E.g., USDA Forest Service
 - 2nd RFI Appeared in December 2012
 - Twelve Responses Received April 1, 2013
 - Proposals are Currently In Review by an Ad Hoc Panel of Experts.

LTAR Begins

- Agriculture faces tremendous challenges over the coming century.
- Addressing these challenges will require transformative changes to agriculture.
- Establishing a long-term agro-ecosystem research network is an important component of understanding how to make these changes.
- The Agricultural Research Service has leveraged existing infrastructure and ongoing research as the foundation for an LTAR network for agriculture.





The LTAR Network's long-term success will depend on...

- Partners...and lots of them
- Capacity building for NEON-inspired instrumentation and measurements
- Resources and policies for data management
- Funding for research itself in the *network*
- Wide interest and use of the network – not just natural resources
- University involvement – in existing locations, and for additional locations
- A spirit of partnership across locations and agencies

